mum width. The first and most interesting eight or ten miles of their length have been drawn by four observers at three different observatories (POPULAR ASTRONOMY, 1914, **22**, 570; 1916, **24**, 77, 273, and 575). They are very difficult, however, and beyond the reach of the average amateur. Diverging double canals are also found on the northwestern inner slopes of Autolycus and Menelaus.

The point on which we wish to lay especial stress in this place, however, is this. It appears that the observer furnished with even a modest 3-inch telescope can see and study the details of the changing coarser lunar canals to better advantage than those furnished with much more powerful instruments can study the canals of Mars. The phenomena are similar, and any conclusions derived from the study of the Martian canals should apply to those of the Moon, and *vice versa*.

Mandeville, Jamaica, B.W.I., June 20, 1919.

THE ROMAN CALENDAR AND ITS REFORMATION BY JULIUS CAESAR.

ROSCOE LAMONT.

After Julius Caesar became the ruler of the Roman world, one of his most important and useful achievements was the reformation of the calendar. The ordinary year of the Romans, before the Julian reform, consisted of 355 days, distributed into twelve months as follows:

January	29 days	Quintilis (later named July)	31 days
February	28 days	Sextilis (later named August)	29 days
March	31 days	September	29 days
April	29 days	October	31 days
May	31 days	November	29 days
June	29 days	December	29 days

Since the solar or tropical year contains nearly 365¼ days, this twelve-month year was too short by 10¼ days, and to make the average length of the civil year agree with the tropical, additional days were inserted. An extra month, consisting alternately of 22 and 23 days, was to be intercalated every other year between the twenty-third and twenty-fourth of February. This increase of 45 days in four years was equivalent to 11¼ days a year, which added to 355 days gave 366¼ days as the mean value. This was one day too great, and to take away this excess a cycle of twenty-four years was employed. In twenty-four years the excess would be twenty-four days, and, therefore, in the last eight years of this cycle sixty-six days were to be intercalated instead of ninety. Thus in a period of twenty-four years the average length of the year was 365¼ days.

This was the scheme according to Censorinus and Macrobius, the two ancient writers who have given the most complete history of the Roman calendar, but the rules laid down were not followed, especially

in later times, for the calendar had fallen into such confusion that in the year 47 B.C., the year preceding the one in which Julius Caesar carried out his reform, the vernal equinox came on or about June fifth. The year of correction, 46 B.C., called by Macrobius the last year of confusion, consisted of fifteen months with 445 days, the intercalary month of 23 days being inserted in February, and two months of 67 days placed between November and December, which caused the equinox to come on March 23 or 24 in the year 45 B.C., the first year of the reformed calendar. If the equinox occurred on June 5 in 47 B.C., in the year 46 it fell on or about May 23, there being 365 days between these two dates by the old calendar, 23 days having been intercalated in February. From May 23 of the year 46 to March 24 of 45 there are 365 days, with 67 days placed between November and December, the number of days in the remainder of the year 46 being computed according to the unreformed calendar, and January in the year 45 having 31 days, the new calendar beginning with that month. This supposes that the year 45 was not a leap year, February having but 28 days.

According to the historian Mommsen the year began on March 1 until the reformed calendar went into effect, and if this was the case, the reason for inserting just 67 days between November and December in the year 46 may have been to make a complete year from March 1 to December 31, the addition of 67 days making the total exactly 365. The following year would then begin on January 1 at the time of the beginning of the reformed calendar. In this case the 445 days mentioned above would not all belong to one calendar year, but would all be included in one consular year, the consular year beginning January 1, Mommsen's view being that the consular and calendar years did not begin on the same date until after the Julian reform.* Considering that the calendar year began on March 1 before the reform, the consular year 47 contained 355 days and the calendar year 378 days, and the consular year 46 consisted of 445 days and the calendar year of 365 days.

Some writers consider that, as 67 days form three intercalary months, two of 22 days and one of 23, and as the intercalary month in the eighteen years before the reform had been omitted three times when it should have been inserted, 67 days, equal to three of these months, were added to the year 46 as a compensation for the previous omissions.

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*Censorinus says that the year in which he was writing was the 283rd of the Julian years, but dating from the calends of January which Julius Caesar made the beginning of the year established by him. This seems to intimate that before the Julian reform the year did not begin on January 1. Dio Cassius, an ancient historian who tells something about the Roman calendar, says that 67 days were added by Caesar as that was the number required to bring the year out even, which seems to mean, if it means anything, that with the addition of 67 days a complete year was formed, which would require the calendar year to have commenced on March 1.

In the Encyclopedia Britannica, in the article on the Calendar, the following statement is made:

"In the distribution of the days through the several months Caesar adopted a simpler and more commodious arrangement than that which has since prevailed. He had ordered that the first, third, fifth, seventh, ninth and eleventh months, that is, January, March, May, July, September and November, should have each thirty-one days, and the other months thirty, excepting February, which in common years should have only twenty-nine, but every fourth year thirty days. This order was interrupted to gratify the vanity of Augustus, by giving the month bearing his name as many days as July, which was named after the first Caesar. A day was accordingly taken from February and given to August; and in order that three months of thirty-one days might not come together, September and November were reduced to thirty days, and thirty-one given to October and December. For so frivolous a reason was the regulation of Caesar abandoned, and a capricious arrangement introduced, which it requires some attention to remember."

This statement has appeared in the Britannica for nearly a hundred years, being found in the article on the Calendar written by Thomas Galloway for the seventh edition published about 1830, and republished in all the succeeding editions, but according to the statements of Censorinus and Macrobius, who tell exactly what Julius Caesar did, there is no truth in it whatever. Many ancient Roman calendars have also been discovered which are shown in the Corpus of Latin Inscriptions. The earliest one, according to Mommsen, dates from the years 723-724 of Rome (31-30 B.C.), and the month following July has thirty-one days. This date was more than twenty years before the name Sextilis was changed to Augustus. While this early calendar is incomplete, containing only the last part of some of the months, from the names of the festivals placed opposite the days the months represented can be determined.

Censorinus, in his book "The Natal Day," written to celebrate the birthday of his friend Cerellius, after discussing a variety of subjects, such as the opinions of the ancient philosophers on the age of the human race, why twins are sometimes born, the distances of the stars, and the music of the spheres, gives a history of the Roman calendar, explaining the manner of making the civil and solar years correspond by means of the intercalary month, and speaks as follows of the confusion into which the calendar had fallen and of the reform of Caesar:

"The pontiffs were charged with making the intercalation, but most of them, on account of enmity or friendship, shortened or lengthened the term of a magistrate, and intercalating more or less according to their pleasure, caused a farmer of the revenue to gain or lose according to the length of the year, thus making worse what was given to them to correct. The disorder was so great that Caius Caesar, chief pontiff, in his third consulate and that of M. Aemilius Lepidus, corrected former abuses by placing two intercalary months of 67 days between November and December, although he had already intercalated 23 days in the month of February, thus giving to that year 445 days. At the same time, to prevent a like error from occurring in the future, he abandoned the intercalary month and regulated the civil year by the course of the sun, adding 10 days to the former 355, so distributed among the seven months having 29 days that two days were added to January, Sextilis and December and one to each of the others, and he placed these days at the ends of the months in order that the religious festi-

vals might remain in their former places. . . . . As to the quarter of a day which it seems completes the true year, he directed that one day be intercalated, after each period of four years, where the month was formerly placed, that is, after Terminalia (February 23rd), which is now called bissextile day. From this year, thus regulated by Julius Caesar, those down to our time are called Julian, and they began at the fourth consulate of Caesar."

Macrobius, in his work, "Saturnalia", after giving a long history of the Roman calendar, describes the Julian reform:

"Julius Caesar added ten days to the former number in order to complete the 365 days which the sun takes to pass through the zodiac; and to take account of the quarter of a day, he directed the pontiffs, who were entrusted with the months and days, to intercalate one day every four years in the same month and in the same place the ancients had intercalated, that is, before the last five days of February, hence this day was called bissextile. The ten days added were distributed in such a way that January, Sextilis and December received two days, April, June, September and November one only. He added nothing to February in order that the religious rites in honor of the gods of the nether world might not be changed. March, May, Quintilis and October remained as they were, their 31 days being a sufficient number, though they had their nones on the seventh as Numa had ordered, Caesar not having changed this arrangement. January, Sextilis and December, to which Caesar added two days, although after Caesar they began to have 31 days, still had their nones on the fifth, nineteen days being counted from the ides to the calends of the following month."

According to these extracts from the the writings of Censorinus and Macrobius, all the months, after the Julian reform, had the same number of days they have today, and the statements of Mr. Galloway in the Britannica are wholly in error. Statements similar to those in the Britannica are found in a work by John Brady, published in London in 1812, entitled, Clavis Calendaria or a Compendious Analysis of the Calendar, but it is probable that Mr. Galloway obtained his information from Sacro Bosco, an Englishman of the thirteenth century, who wrote a book called "De anni ratione", which he states was written in the year 1232, Mr. Galloway making a reference to this book. An edition of this work, which is in Latin, was published in Antwerp in 1551, and the part relating to the reform of the calendar by Julius Caesar is as follows:

"Julius Caesar distributed the days among the months so that the odd months had thirty-one days and the even ones thirty; but when he came to January, the last odd month, one day was lacking. He therefore subtracted one day from February to complete the number for January, which February recovered in the bissextile year.* Also in the time of Julius Caesar, the Romans, flattering him, gave the name Julius to the month which before was called Quintilis, because he was born in that time. Likewise in the time of Augustus the month which before was called Sextilis they named Augustus. But then Augustus, envious because his month was shorter than the month Julius, stole one day from February and added it to Augustus (August), hence February remained with 28 days. Another inconvenience resulted, three months of 31 days coming together, namely,

*His belief was that before the Julian reform the year, beginning with March, consisted of 354 days, the months having alternately 29 and 30 days; that eleven days were added by Caesar, two days being given to five of the months containing 29 days, beginning with March, and there being only one day left to give to January, in order to make up its number 31, February was reduced to 29 days.

July, August and September. He therefore took one day from September and assigned it to October, and likewise one day from November which he added to December. And this disposition of the months and arrangement of the number of days, which it will be allowed was reprehensible, the Church uses even today."

If a change such as he describes was really made, everybody no doubt would allow that it was reprehensible. What Mr. Galloway says it simply a good translation from Sacro Bosco's work, and the question is, where did Sacro Bosco get his information? He gives no authority for any of his statements, which are altogether different from anything the Roman writers say, and if he merely gave the arrangement he thought Julius Caesar ought to have made, as seems probable, with a theory as to how that arrangement came to be disturbed, his statements being given a wide circulation by the Britannica and reproduced in many other works on the calendar, there would seem to be a good deal of truth in the saying of Voltaire, that history is fable agreed upon.

In 1866 Lepsius discovered at Tanis, Egypt, a stone on which there was a long inscription in the Egyptian and the Greek language. This stone is known as the Tanis or Canopus stone, a cast of which is in the National Museum at Washington, and the inscription was found to contain a decree establishing a new calendar in Egypt in the year 238 B. C., a translation of this part of the writing, as made by Budge, being as follows:

"And in order that it may happen that that which hath been decreed to be done at each season of the year may be done in accordance with the position which the heavens have with reference to the things which have to be performed at the present time, so that occasion may not be given and the case may not arise that some of the festivals which are celebrated in Egypt in the winter should come to be observed in the summer, in consequence of the rising of Sirius advancing one day every four years, and on the other hand some of the festivals which are at the present time celebrated in the summer should come in the future to be celebrated in the winter, a thing which actually happened in the times which are past, and would happen at the present time if the year consisted of 360 days and the 5 days according to the directions for adding the additional days which have been observed: from this time onwards one day, a festival of the Good-doing Gods, shall be added every four years to the five additional days which come before the new year, so that it may happen that every man shall know that the small amount of time which was lacking in the arrangement of the seasons and of the year and in the things which passed as laws for the knowledge of their movements, hath been corrected, and that it hath been supplied by the Good-doing Gods."

This calendar is identical with the Julian, except as to the number of days in the months, and it required, therefore, no great skill on Caesar's part to establish the reformed Roman calendar, since one with the same length of the year and the same method of intercalation had been established in Egypt nearly two hundred years before, and cut on a stone seven feet high. Dio Cassius, in his History of Rome, says that "he got this improvement from his stay in Alexandria", and the astronomer Sosigenes, coming from Egypt, executed the work. This makes it somewhat amusing to read in Anthon's Classical Dictionary:

When we consider the imperfections of all mathematical instruments in the time of Caesar and the total want of telescopes, we cannot but view with admir-

ation, not unmixed with astonishment, that comprehensive genius which, in the infancy of science, could surmount such difficulties and arrange a system that experienced but a trifling derangement in the course of sixteen centuries."

Julius Caesar did not live to see that the calendar got safely started on its course, he having been assassinated in the year 44 B. C., and the pontiffs, through a misunderstanding or by design, made every third year a leap year instead of every fourth. This continued until there had been twelve leap years when there should have been but nine, and to make the proper correction Augustus ordered the omission of intercalations during the next twelve years, thus cancelling the former error.

It is stated by Dio Cassius that in the year 41 B. C., an extra day was added to prevent the market day, which occurred every eight days, from coming on the first day of the following year. The market or nundinal day came at the end of an eight-day week which ran on from one year to another the same as our seven-day week. For example, if the market day came on the next to the last day of the year, the first one in the following year would fall on the seventh of January. While the market day could thus come on any day of the year, it was thought to be a bad omen if it came on the first day of the year, and a day was sometimes added in order to prevent this. With every third year a leap year there is a three year cycle, and since the sum of 365, 365 and 366 is 1096, which is a multiple of 8, if in one such series of three years the market day does not fall on the first of January, then by continuing to make every third year a leap year it would never fall on the first of January, and some writers have maintained that the pontiffs intentionally made every third year a leap year in order to prevent the market day from falling on the first day of the year, Dio Cassius stating that a day was added for this reason only four years after the establishment of the Julian calendar. But it seems more reasonable to suppose that a mistake was made by the pontiffs, and that the extra day was added in the year 41 because of some disturbance which had occurred during the civil war. Caesar's order was, according to Macrobius, that every fourth year should be leap year, but since the Romans, in counting from one event to another in a series of years, included the year at the beginning as well as the one at the end, the direction to intercalate every fourth year might have been understood to mean what in our reckoning would be expressed by every third year.

There is a possibility, however, that every third year was made a leap year because of the market-day superstition. About the time Augustus made the correction in the method of intercalation he became Pontifex Maximus, the head of the College of Pontiffs which had entire charge of all matters pertaining to the calendar; the month Sextilis was named Augustus in his honor; on his birthday, September 23, which was celebrated as a holiday, he obtained the privilege of having a horse race perpetually (so Dio Cassius says), and he may have thought it time to

abandon a superstitious practice and regulate the calendar as his great-uncle Julius Caesar had directed.

There is a disagreement among writers on the Julian calendar as to which were the leap years during the time they were reckoned every third year, and also as to the years in which the intercalations were omitted by order of Augustus. Some hold that 45 B. C. was the first leap year, others the year 44, others 42. As to the year 41 a difficulty arises because of the extra day that Dio says was added so that the first day of the following year would not be the time for the farmers to go to town and cause some disaster to the state. Dio says that naturally a day would be subtracted later, but he apparently doesn't know whether it was or not, or if so in what year, and nobody else knows. There seems to be some confusion still, and it would have been well if Caesar had lived a few years longer to have taught the Romans that the excess quarter of a day would form a whole one by taking it four times instead of three, and that preventing the market day from coming on New Year's day was not of sufficient importance to justify tampering with the calendar.

Thirty years after the establishment of the Julian calendar a governor of Gaul, appointed by Augustus, made the year consist of fourteen months in places where the people paid taxes by the month. He told them that December was really the tenth month (decem, ten), and therefore it was necessary to add two more, which he called Undecimber and Duodecimber, and made them pay taxes for those two.*

There is no agreement among writers, either ancient or modern, as to the position of the extra day inserted in February in leap year. This day was called bissextus (twice-sixth), the sixth day before the calends or the first day of March being counted twice, and the question is whether the inserted day was to be considered as the one immediately after the twenty-third of February or the second one after the twenty-third. The Romans numbered the days as so many days preceding some date in the future, instead of so many days after a date in the past as we do, and it seems sensible to hold that the day called bissextus, twice-sixth or the second-sixth, followed the first-sixth, and that, therefore, the intercalary day was the second one after the twenty-third of February. This view is confirmed by an inscription of the year 168 A. D., which states that a temple was dedicated on the fifth of the calends of March of that year, which followed the bissextile day. This also seems to be in accordance with the decision of the Roman judges, quoted by Mommsen in his Roman Chronology, the decision being that the day posteriore was to be considered as the intercalary day, the two days which were named the sixth of the calends of March being called priore and posteriore. That the day inserted in February in leap year was the second one after the twenty-third is maintained by Mommsen, but other

*Dio Cassius, Book 54, Chapter 21.

writers of equal authority, as Ideler and Bouché Leclercq, dispute this and hold that the intercalary day immediately followed February 23, which agrees with the statements of Censorinus and Macrobius, and is also in accordance with old Church calendars.

A number of theories have been proposed to account for the name leap year, some holding that it is a misnomer, there being no leap made. The best explanation, and the one accepted by the modern dictionaries, is that given by Hearne in his Ductor Historicus or a Short System of Universal History, published in 1704, as follows:

> "That year was called bissextile, and by us leap year, because one day of the week is leaped over in the observation of the festivals by reason of the additional day in that year."

Since in a common year there are fifty-two weeks and one day and in leap year fifty-two weeks and two days, any fixed festival after February, which comes, say, on Monday in one year, and in the following year, if a common year, on Tuesday, will come in the next year, if one of 366 days, not on Wednesday but on Thursday, leaping over one day. For a festival in January and February the leap will be made in the year following the leap year.

The manner in which the Romans named the days of the month seems a little clumsy, and Delambre says it savors of ignorance and barbarism, but the method is easily understood and not difficult to use, and was employed by historians until the sixteenth and seventeenth centuries. There were three days in each month called the calends, nones and ides, and the days were reckoned according to the number of days preceding one of these. The ides were the fifteenth of March, May, July and October, and the thirteenth of the other months. The nones were eight days before the ides (nine days according to the Roman method of counting inclusively) and came on the seventh of March, May, July and October, and on the fifth of the other months. The first day of the month was called the calends. Between the calends and nones the day of the month was the number of days preceding the nones, between the nones and the ides, the number of days preceding the ides, and after the ides the date was the number of days before the calends of the following month, in each case the day *from* which the reckoning was made being included as well as the day *to* which it was made. The day following the calends of March was the sixth day before the nones, the day following the nones the eighth day before the ides, and the day following the ides the seventeenth day before the calends of April.

A method similar to this is sometimes used now. A few days before Christmas the papers print from day to day notices to shop early as it is only ten days before Christmas, nine days before Christmas, and so on. To Young America the almanac date July third is the day before the fourth. This was the Roman method (also used by some of the Greek states, each of which had a calendar of its own), to look forward

to some fixed date in the future and count the number of days preceding this fixed date, instead of looking backward to the first of the month as is done now and reckoning the date as the number of days after the first of the month.

In early times, when the lunar month was used, the calends was the day after the new moon was first seen in the heavens, the nones were supposed to be at the first quarter, and the ides at the full moon, and Macrobius describes the ancient custom of calling the people together as soon as the new moon was visible, when the pontiff announced the day on which the nones would occur. If the nones were on the fifth the Greek word kalo (I call) was repeated five times, and if on the seventh, was repeated seven times, and hence the day on which the announcement was made was named the calends and the place of assembling was called the Calabra. When the intercalary month was later employed to make the year correspond with the solar year, the calends, nones and ides continued to be used although they had no relation to the moon.

Plutarch, who was a Greek writer, says in his life of Numa that the intercalary month was called by the Romans Mercedinus, and in his life of Julius Caesar the form Mercedonius is used, but as this month is never given any such name by the Roman writers, it being called simply mensis intercalaris, the German writer Unger, in his work on the Roman calendar, considers that Plutarch's statement was based on a misunderstanding. Unger refers to a work by Lydus "On the Months," in which it is stated that November was called Mercedinus in ancient times, and he supposes that Plutarch confused the intercalary months placed after November in the year 46 B. C. with the month inserted in February. According to this view the year of confusion was the cause of still more confusion. Whether this is correct or not, and it seems quite improbable, some modern writers on the calendar think it a little strange, if the intercalary month was called Mercedonius by the Romans, that the Roman writers were not aware of it.

Macrobius makes the following statements with regard to changing the names of the months Quintilis and Sextilis to July and August:

> "Quintilis, by a law proposed by the consul Marcus Antonius, son of Marcus, was called Julius (July) in honor of the dictator Julius Caesar who was born the fourth of the ides of this month."
>
> "August, which was formerly called Sextilis, was afterwards named in honor of Augustus by a Decree of the Senate in the following words: Whereas the Emperor Augustus Caesar in the month of Sextilis was first admitted to the consulate and thrice entered the city in triumph, and in the same month the legions from the Janiculum placed themselves under his auspices, and in the same month Egypt was brought under the authority of the Roman people, and in the same month an end was brought to the civil wars, and whereas for these reasons the said month is and has been most fortunate to this empire, it is hereby decreed by the Senate that the said month shall be called Augustus."

Julius Caesar and Augustus having been honored by giving their names to two of the months, other emperors desired the same honor.

Suetonius says that the Emperor Nero called the month of April Neroneus, and that Caligula called September Germanicus in honor of his father. It is a good thing these names did not stick. Just imagine anyone having to say:

Thirty days hath Germanicus,
June, November and Neroneus.

At a later time the Emperor Charlemagne, wishing to Germanize everything, changed the names of all the months, his biographer Einhard saying that he wanted names in his own language instead of the barbarous Latin names formerly used, calling January, Wintarmanoth; February, Hornung; March, Lentzinmanoth; April, Ostarmanoth; May, Winnemanoth; June, Brachmanoth; July, Heuvimanoth; August, Aranmanoth; September, Witumanoth; October, Windumemanoth; November, Herbistmanoth; December, Heilagmanoth.

In speaking of the origin of the names of the days and their use by the Romans Dio Cassius says:

"The custom of referring the days to the seven stars called planets was established by the Egyptians, but has spread to all men, though it was instituted comparatively not long ago. At any rate the original Greeks in no case understood it so far as I am aware. But since it has become quite habitual to all the rest of mankind and to the Romans themselves, and is to them already in a way a hereditary possession, I wish to make a few brief statements about it, telling how and in what way it has been so arranged. I have heard two accounts, in general not difficult of comprehension and containing some one's theories. If one apply the so-called principle of the tetrachord, which is believed to constitute the basis of music, in order to these stars by which the whole universe of heaven is divided into regular intervals, as each one of them revolves, and beginning at the outer orbit assigned to Saturn, then omitting the next two, name the master of the fourth, and after passing over two others reach the seventh, and in the return cycle approach them and the presiding gods in this same way, calling them by the names of the days, one will find all the days to be in a kind of musical connection with the arrangement of the heavens. This is one of the accounts."

To show clearly what Dio means, in column (1) below the seven planets of the ancient astronomy are arranged in the order of their distances from the earth, beginning with Saturn, the outermost one. In column (2), opposite each planet, is placed the day which was consecrated to the planet, using the English names, and in column (3) the days in the order in which we know them. Column (4) gives the Latin names in the order of column (3).

(1)	(2)	(3)	(4)
Saturn	Saturday	Saturday	dies Saturni
Jupiter	Thursday	Sunday	dies Solis
Mars	Tuesday	Monday	dies Lunae
Sun	Sunday	Tuesday	dies Marti
Venus	Friday	Wednesday	dies Mercurii
Mercury	Wednesday	Thursday	dies Jovis
Moon	Monday	Friday	dies Veneris

Having given in column (1) the planets in the order of their distance from the earth, and in column (2) the days of the week in the order corresponding, the problem is to discover how the days came to be arranged in the order given in column (3).

The word tetrachord means four chords. Starting with Saturn, opposite which is Saturday, pass over two planets and the fourth one is the sun opposite which is Sunday; by omitting two more we come to the moon opposite which is Monday; by skipping the next two (going back to the beginning) we come to Mars opposite which is Tuesday, and by continuing in this way come successively to the planets opposite which are Wednesday, Thursday and Friday.

Dio continues:

> The other account is as follows: If you begin at the first one to count the hours of the day and of the night, assigning the first to Saturn, the next to Jupiter, the third to Mars, the fourth to the Sun, the fifth to Venus, the sixth to Mercury and the seventh to the moon, and then repeat the process covering these twenty-four hours, you will find that the first hour of the following day comes to the Sun. And if you carry on the operation throughout the next twenty-four hours by the same method as outlined above, you will consecrate the first hour of the third day to the moon, and if you proceed similarly through the rest, each day will receive the god that pertains to it. This then is the tradition."

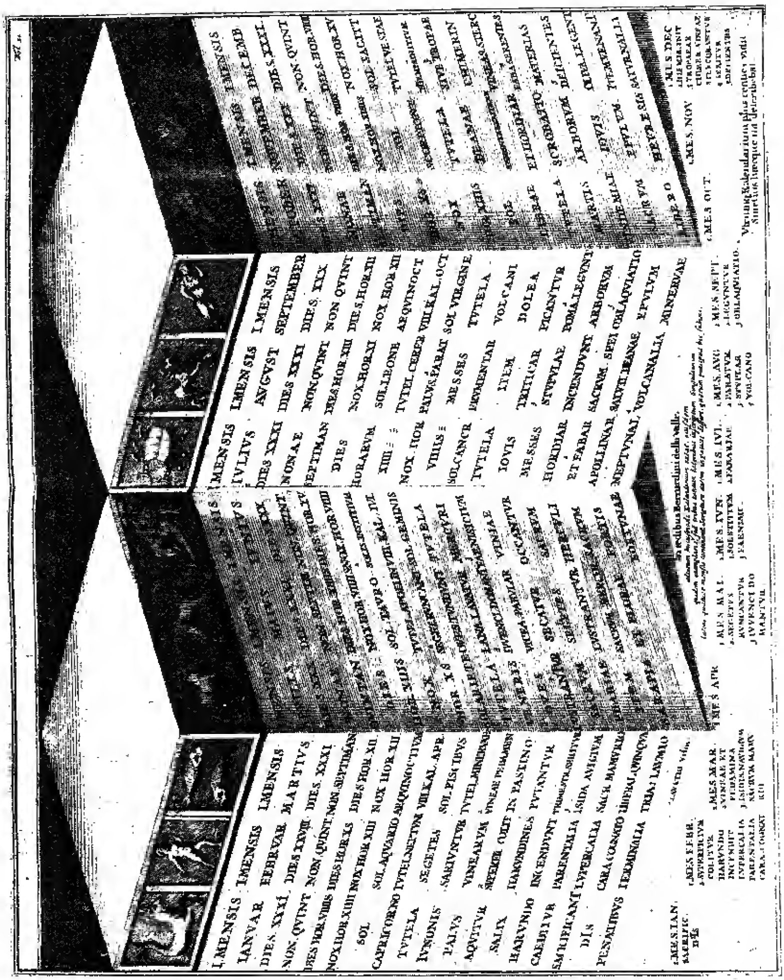
There are twenty-four hours in the day and each hour of the day is consecrated to some planet, and the planet to which the first hour of the day is consecrated gives its name to the day.

Dio says that in his time (the fore part of the third century) the names of the days in the order given above were a hereditary possession, and they probably had been in use for two hundred years. In July 1901, in making excavations in Pompeii (destroyed in 79 A. D.), there was found written on a wall in one of the houses the following names:

SATURNI
SOLIS
LUNAE
MARTI
JOVIS
VENERIS

These are the Latin names of the days in the order now in use, with the exception of Mercurii (Wednesday), which was doubtless left out through inadvertence. Among the pictures found at Herculaneum there is one of the seven dieties who presided over the days of the week arranged in the order of the days as follows: Saturn, Apollo, Diana, Mars, Mercury, Jupiter, Venus.

Macrobius says that Augustus ordered the correct rule of intercalation to be cut on a table of brass that it might be observed perpetually. It was the custom among the Romans to cut calendars on stone and place them at the crossroads, informing the husbandmen not only of the time to shear their sheep and pick their apples, but of their religious duties as well. An interesting calendar of this kind, discovered about the year 1550, is now in the National Museum at Naples. A picture of this calendar may be seen in most books on classical antiquities, but the one here shown was taken from Graevius' Thesaurus of Roman An-



AN ANCIENT CALENDAR.

tiquities, published in 1698. The small figures above some of the words do not belong to the calendar, but refer to words placed below, of a different form, that are found on other similar calendars which have been discovered. A picture of one on which these variations occur is given in Gruter's Roman Inscriptions, the form of the calendar being a prism with four months on each face.

It will be seen that a great deal of astronomical, agricultural and religious information is furnished the farmer. The name of the month is first given, then the number of days in the month, the position of the nones (the ides being always eight days after the nones it was not necessary to speak of the ides), the number of hours in the day and night, the position of the equinoxes and solstices, the sign of the zodiac in which the sun was to be found, the god under whose protection the month was placed, the labors that were to be performed during the month, and the religious festivals which occurred in the month. Take the month of May: It has thirty-one days, the nones are on the seventh, the day consists of fourteen and one-half hours, the night of nine and one-half hours (the S stands for semis, half), the sun is in the sign of Taurus, the month is under the protection of Apollo, the corn is weeded, the sheep are sheared, the wool is washed, the steers are broken in, the vetch is cut for fodder, the corn fields are purified, sacrifices are made to Mercury and Flora.

A Farm Journal, a Church paper, and a modern almanac in one.

DESIGN OF A STELLAR PHOTOMETER.

G. A. SHOOK.

In the design of a stellar photometer, to be used on an equatorial, there are three things to be considered:—an artificial star of constant intensity, a means of bringing the image of this star into the field of view of the telescope, and a method for varying the intensity of the standard star in a continuous and determinate manner. The difference in color is, to be sure, a disturbing factor and in precise work the color of the standard star should be very near the same as that of the real star.

A simple method for varying the intensity of the standard star is by means of a neutral tint wedge such as is made by the Eastman Kodak Co. These wedges are furnished in various transmission ranges from 1 to 1/2 down to 1 to 1/10000. A wedge with a range of 1 to 1/100 would enable one to compare stars of the first magnitude down to the sixth magnitude. A greater range is obtained if we vary both the real and the standard star. For the brighter stars an absorption screen might be used to cut down the light from the real star and the balance could be made with the wedge.